

C-AD OPM 13.6.1.a Design Review Questionnaire

Design Review Questionnaire		Prepared by:
Revision #	<input type="text" value="00"/>	<input type="text" value="A.Rusek"/>
Project/Equipment Description:		
<input type="text" value="Addition of new quadrupole magnet to the R-line (NSRL)"/>		
Date:	Reviewed by:	Drawing # (s)
<input type="text" value="November 29<sup>th</sup>, 2007.."/>	<input type="text"/>	<input type="text" value="List (#, #):"/>

Indicate Applicable Sections of Questionnaire:

- ☒ [A. General Design Questions \(Required\)](#)
- ☒ [B. Safety, Security and Quality Assurance \(Required\)](#)
- ☐ [C. Electrical forms](#)
- ☐ [D. Structural and Pressurized Systems](#)
- ☐ [E. Equipment Layout and Installation](#)
- ☐ [F. Ionizing Radiation Shielding](#)
- ☐ [G. Materials](#)
- ☐ [H. Vacuum](#)
- ☐ [I. Drawings](#)
- ☐ [J. Thermal](#)
- ☐ [K. Vibration, Noise and Natural Phenomena](#)
- ☐ [L. Manufacturing](#)
- ☐ [M. Software, PLC, Firmware, Human Factors and Controls](#)

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Summary of documentation to be included in the final design review file (see blue shaded boxes in questionnaire):

<input checked="" type="checkbox"/>	Calculations
<input checked="" type="checkbox"/>	Specifications
<input checked="" type="checkbox"/>	Drawing(s)
<input type="checkbox"/>	Materials Certifications
<input type="checkbox"/>	Welding Certifications
<input type="checkbox"/>	Test Results
<input type="checkbox"/>	Equivalence or Variance
<input checked="" type="checkbox"/>	Procedures

If the Section (A, B, C, etc.) is applicable, then indicate full answer where required. Indicate Yes/No/NA/TBD in last column where required. If the entire Section is not applicable, then go to the next Section. (Note: TBD = to be determined and NA = not applicable)

A. General Design Questions (Required)

General Comments on Section A

1.	Has the design criteria been fixed and agreed to by all involved?	<input checked="" type="checkbox"/> Yes
2.	Is there a cost estimate and project schedule?	<input checked="" type="checkbox"/> Yes
3.	Will the controls be ergonomically designed (i.e. clear, easy to reach and operate)? (Refer to Human Factor requirements in SBMS Ergonomics/Occupational subject area)	<input checked="" type="checkbox"/> Yes
4.	What is the design life, and does the design meet the needs over the required life?	<div></div>

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5.	<p>What efforts will be taken to assure that the design criteria will be met by this design?</p> <p>(Check all that apply)</p> <p><input checked="" type="checkbox"/> Engineering investigations</p> <p><input checked="" type="checkbox"/> Computer modeling or simulation</p> <p><input checked="" type="checkbox"/> Tests</p> <p><input checked="" type="checkbox"/> Analyses</p>	
6.	<p>What other design approaches were considered and why were they rejected?</p> <div style="border: 1px solid black; padding: 5px; min-height: 40px;"> <p>none</p> </div>	
7.	<p>Which Groups specifically will be impacted by the new design?</p> <div style="border: 1px solid black; padding: 5px; min-height: 40px;"> <p>NSRL operations, CA-D operations</p> </div>	
8.	<p>Will access to other equipment be impaired or limited?</p>	<p><input type="checkbox"/> No</p>
9.	<p>What components or hardware need to be maintained for spares, and are they readily available?</p> <div style="border: 1px solid black; padding: 5px; min-height: 60px;"> <p>the power supply will need spares, which will be purchased with the power supply itself.</p> </div>	
10.	<p>What are the anticipated maintenance requirements for the installation?</p> <div style="border: 1px solid black; padding: 5px; min-height: 40px;"> <p>Standard power supply and cooling water maintenance.</p> </div>	
11.	<p>Will any consumables be used (e.g., oil, grease, foils, seals, vacuum tubes, etc.)?</p>	<p><input type="checkbox"/> No</p>

B. Safety, Security and Quality Assurance (Required)

General Comments on Section B

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12.	Will any chemicals be used? If so, are they approved and listed on the CMS?	<input type="checkbox"/> No <input type="checkbox"/> N/A
13.	Will any of the materials chosen give off toxic fumes when heated or burned?	<input type="checkbox"/> N/A
14.	Will any of the materials selected present a disposal or environmental problem?	<input type="checkbox"/> N/A
15.	Will materials and components be checked for counterfeit parts?	<input type="checkbox"/> Yes
16.	Will materials or components have to be stored in secured areas?	<input type="checkbox"/> Yes
17.	Please specify the Quality Classification https://sbms.bnl.gov/sbmsearch/subjarea/73/7304e011.doc (A1, A2, A3 or A4) <input type="checkbox"/> Overall system classification <input type="checkbox"/> Highest classification of any subsystem	

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18.	<p>What safety review committees are involved, or will be involved, in the review?</p> <p><input checked="" type="checkbox"/> Accelerator Systems Safety Review Committee</p> <p><input checked="" type="checkbox"/> Experimental Safety Review Committee</p> <p><input checked="" type="checkbox"/> Radiation Safety Committee</p> <p><input type="checkbox"/> ALARA Committee</p> <p><input type="checkbox"/> Security Committee</p> <p><input type="checkbox"/> BNL Cryogenic and Pressure Safety Committee</p> <p><input type="checkbox"/> Other: <input type="text"/></p>
19.	<p>Have you contacted all the appropriate safety committees?</p> <p><input type="text" value="TBD"/></p>
20.	<p>Have you completed the Hazard Screening Questionnaire? www.rhichome.bnl.gov/AGS/Accel/SND/C-AHazardTool/C-AD Hazard Screen for OPM 9.11.pdf</p> <p><input type="text" value="No"/></p>
21.	<p>What acceptance tests will be needed?</p> <p><input type="text" value="The power supply, imaging chamber , magnet white-sheets"/></p> <p>How, and where will they be performed?</p> <p><input type="text" value="Power supply before installation, rest during commissioning."/></p>
22.	<p>Will intermediate tests be needed during assembly to validate each stage, phase, or component?</p> <p><input type="text" value="No"/></p>
23.	<p>What standards and specifications will be used to determine if the individual components (and final assembly/installation) are acceptable?</p> <p><input type="text" value="Original specs on the power supply."/></p>

24.	Are documentation and certifications needed for acceptance?	<input checked="" type="checkbox"/> Yes
25.	Are preventative maintenance and safety procedures required?	<input checked="" type="checkbox"/> No
26.	Does this work involve the use, research, and/or development of materials, equipment, or procedures related to the nuclear fuel cycle? If yes, describe: <div style="border: 1px solid black; height: 50px; width: 600px;"></div>	<input checked="" type="checkbox"/> No

C. Electrical

General Comments on Section C

The system will comply with NEC

27.	Will fuses and circuit breakers be coordinated?	<input checked="" type="checkbox"/> Yes
28.	Has the temperature rise of all conductors been considered?	<input checked="" type="checkbox"/> Yes
29.	Are there any special grounding and bonding requirements? If yes, please explain:	<input checked="" type="checkbox"/> No
30.	Will there be strain relief provisions included in all cables and wires, and will they be secured as necessary to prevent damage or insulation failure from vibration, pinching, chaffing, or other movement?	<input checked="" type="checkbox"/> Yes
31.	For all the materials and components used, have flammability and radiation damage issues been considered?	<input checked="" type="checkbox"/> Yes

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32.	Have energy-discharge issues been considered for energy storage devices?	<input type="checkbox"/> Yes
33.	Have LO/TO provisions been made?	<input type="checkbox"/> Yes
34.	What type of cooling will be provided? <u>Water Cooling</u> :	
35.	Will you be requesting an equivalence or variance from any NFPA, NEC and OSHA requirement?	<input type="checkbox"/> No
36.	Will an NEC design class be selected for operation in flammable or explosive environments?	<input type="checkbox"/> No
37.	If batteries are installed, will code requirements such as eye wash stations and ventilation be implemented?	<input type="checkbox"/> N/A
38.	Is an emergency stop button needed?	<input type="checkbox"/> N/A
39.	Are there arc blast or arc flash concerns?	<input type="checkbox"/> Yes
40.	Will this design use equipment that needs to be inspected by an Electrical Equipment Inspector (EEI) before being put into service?	<input type="checkbox"/> Yes
41.	Will correct electrical hazard labeling and signage be specified?	<input type="checkbox"/> Yes
D. Structural and Pressurized Systems General Comments on Section D <div style="border: 1px solid black; height: 50px; width: 100%;"></div>		
42.	Will all of the loads (including transportation, floor loading, anticipated use, and handling loads) be properly identified and distributed?	<input type="checkbox"/> Yes

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43.	Will thermal loads (e.g. from expansion / contraction) be included with the structural loads?	N/A
44.	Will dynamic loads be identified and included?	N/A
45.	Will fatigue, creep, cyclic loading, or any critical structural conditions be identified and included?	N/A
46.	<p>Which codes will apply to the analysis:</p> <p><input type="checkbox"/> American Society of Mechanical Engineers (ASME) Boilers and Pressure Vessel Code, sections I through XII including applicable Code Cases, (2004)</p> <p>ASME B31 (ASME Code for Pressure Piping) as follows:</p> <p><input type="checkbox"/> B31.1—2001—Power Piping, and B31.1a—2002—Addenda to ASME B31.1—2001</p> <p><input type="checkbox"/> B31.2—1968—Fuel Gas Piping</p> <p><input type="checkbox"/> B31.3—2002—Process Piping</p> <p><input type="checkbox"/> B31.4—2002—Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids</p> <p><input type="checkbox"/> B31.5—2001—Refrigeration Piping and Heat Transfer Components, and B31.5a—2004, Addenda to ASME B31.5—2001</p> <p><input type="checkbox"/> B31.8—2003—Gas Transmission and Distribution Piping Systems</p> <p><input type="checkbox"/> B31.8S—2001—Managing System Integrity of Gas Pipelines</p> <p><input type="checkbox"/> B31.9—1996—Building Services Piping</p> <p><input type="checkbox"/> B31.11—2002—Slurry Transportation Piping Systems</p> <p><input type="checkbox"/> B31G—1991—Manual for Determining Remaining Strength of Corroded Pipelines</p>	
47.	Will materials certifications be required?	Yes
48.	Will welding certifications be required?	No
49.	Will code stamps be required?	No

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50.	Will the material have QA requirements?	<input type="checkbox"/> Yes
51.	Will requirements for proper stress relief (if needed) be included?	<input type="checkbox"/> Yes
52.	Will margins of safety be determined and specified?	<input type="checkbox"/> Yes
53.	Will calculations require independent review?	<input type="checkbox"/> No
54.	Will finite element analysis be required?	<input type="checkbox"/> No
55.	Will hand calculations be used to check and bound the results of finite element analysis?	<input type="checkbox"/> N/A

E. Equipment Layout and Installation

General Comments on Section E

56.	Will components move?	<input type="checkbox"/> No
57.	Will exclusion zones, clearance zones, guards, or shields be needed?	<input type="checkbox"/> Yes
58.	Could any body parts be pinched if components were to move unexpectedly?	<input type="checkbox"/> No
59.	Will the potential exist for body parts to contact anything hazardous?	<input type="checkbox"/> No
60.	Will there be adequate clearance over the full range of motion allowed to all moving and movable parts?	<input type="checkbox"/> N/A
61.	Will drive motors or actuators accelerate the load (including friction) sufficiently?	<input type="checkbox"/> N/A

F. Ionizing Radiation Shielding

General Comments on Section F

No shielding modifications needed. This section N/A.

62.	<p>What will determine the shielding requirements?</p> <p><input type="checkbox"/> ALARA concerns</p> <p><input type="checkbox"/> Machine protection / radiation damage to parts</p> <p><input type="checkbox"/> Personnel safety</p> <p><input type="checkbox"/> Environmental issue (e.g., to prevent ground water contamination)</p>	
63.	Will shielding calculations be performed and checked by an independent party?	N/A
64.	Will approvals be required from the C-AD Radiation Safety Committee for the proposed shielding?	N/A
65.	Will approved shielding drawings be used?	N/A

G. Materials

General Comments on Section G

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66.	Will materials have delivery requirements?	No
67.	Will materials have security requirements if stored at C-AD?	Yes

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68.	<p>Will any of the materials chosen be:</p> <p><input type="checkbox"/> High value metals</p> <p><input checked="" type="checkbox"/> Targets for theft</p> <p><input type="checkbox"/> Required to be on the C-AD Valuable Materials List (OPM 1.20) www.rhichome.bnl.gov/AGS/Accel/SND/OPM/Ch01/01-20.PDF</p> <p><input type="checkbox"/> Marked or identified as "US Government Property"</p>	
69.	Will manufacturers, federal, military, or other specifications be used?	<input type="text" value="Yes"/>
70.	Will C-AD/BNL specifications documents be used?	<input type="text" value="Yes"/>
71.	<p>Will any of the materials chosen degrade significantly in use due to:</p> <p><input type="checkbox"/> Galvanic and/or chemical corrosion</p> <p><input type="checkbox"/> Rust/oxidation</p> <p><input type="checkbox"/> Creep</p> <p><input type="checkbox"/> Fatigue</p> <p><input type="checkbox"/> Thermal effects</p> <p><input type="checkbox"/> Ionizing radiation effects</p> <p><input type="checkbox"/> Galling</p> <p><input type="checkbox"/> Excess wear</p> <p><input type="checkbox"/> Non-ionizing radiation effects (e.g. visible/UV light)</p> <p><input type="checkbox"/> Aging</p> <p><input type="checkbox"/> Erosion</p> <p><input type="checkbox"/> Normal operation</p>	
72.	Will the materials be compatible with each other and suitable for the application (including all potential operating environments)?	<input type="text" value="Yes"/>
73.	Will the materials chosen be readily joined (e.g. by welding, brazing, etc)?	<input type="text" value="Yes"/>

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74.	Will any of the materials chosen be: <input checked="" type="checkbox"/> Sole sourced <input checked="" type="checkbox"/> Available only from a single supplier	
75.	What components will wear and what are the implications of wear? <div style="border: 1px solid black; padding: 5px; min-height: 40px;">N/A</div>	
H. Vacuum General Comments on Section H <div style="border: 1px solid black; height: 50px; margin-top: 10px;"></div>		
76.	Will all materials be vacuum-compatible and will the design be acceptable for vacuum service?	<input checked="" type="checkbox"/> Yes
77.	Will the vapor pressures of the selected materials be acceptable to the Vacuum Engineer?	<input checked="" type="checkbox"/> Yes
78.	Are there any trapped volumes that are not adequately vented?	<input type="checkbox"/> No
79.	Are vented fasteners or relief channels used where needed?	<input type="checkbox"/> N/A
80.	Will bushings, bearings, low friction materials/surface treatments be used?	<input type="checkbox"/> N/A
81.	Will weld joint design be appropriate for vacuum service?	<input checked="" type="checkbox"/> Yes
82.	Will there be any in-vacuum transitions or water-to-vacuum weld or braze joints whereby a water-to-vacuum, cryogen to vacuum or any fluid-to-vacuum leak could result?	<input type="checkbox"/> No

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83.	What provisions will be included to release pressure for any failure that allows in-vacuum components to become pressurized?	
	N/A	
84.	If in-vacuum, will the appropriate materials, finishes, and cleaning processes be chosen?	<input checked="" type="checkbox"/> Yes
85.	Will there be any steel or cadmium-plated materials in the vacuum?	<input type="checkbox"/> No
86.	Will there be any vendor hardware used that is not designed for vacuum compatibility?	<input type="checkbox"/> No
87.	Will any greases, lubricants, or chemicals be used in vacuum?	<input type="checkbox"/> No
88.	Are special vacuum flanges or seals required?	<input type="checkbox"/> No
89.	Will special cleaning procedures be required?	<input type="checkbox"/> No
90.	Will intermediate leak checks be performed before final assembly or installation?	<input checked="" type="checkbox"/> Yes
91.	If vacuum bake-out is needed, will all of the materials withstand bake-out temperatures (thermal growth effects, low ignition temperature, etc.)?	<input checked="" type="checkbox"/> Yes
92.	Will bake-out procedures be required?	<input checked="" type="checkbox"/> Yes
93.	Will thin vacuum windows be used?	<input type="checkbox"/> No
94.	Will vacuum windows need to be protected from the environment or workers during installation and/or nearby maintenance?	<input type="checkbox"/> N/A
95.	Will the design be reviewed by a Vacuum Engineer?	<input checked="" type="checkbox"/> Yes

I. Drawings

General Comments on Section I

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96.	Will detailed fabrication drawings or specifications be required?	<input checked="" type="checkbox"/> Yes
97.	Will the workload in the design room be considered with regard to schedule?	<input type="checkbox"/> No
98.	Should a designer be involved in a preliminary design review?	<input checked="" type="checkbox"/> Yes
99.	Will the drawings be reviewed with the technicians who will do the assembly and installation?	<input checked="" type="checkbox"/> Yes

J. Thermal

General Comments on Section J

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100.	Will there be thermal loads from any energy source (e.g., electric current, particle beam, electromagnetic radiation, neutrons)?	<input checked="" type="checkbox"/> Yes
101.	Will thermal and stress analysis be performed?	<input type="checkbox"/> No
102.	Will the effects of transient thermal conditions be considered?	<input checked="" type="checkbox"/> Yes
103.	Can temperatures exceed normal operating conditions?	<input checked="" type="checkbox"/> Yes
104.	Will thermal limits or controls be required?	<input checked="" type="checkbox"/> Yes

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105.	Where will the signals from thermal sensors be sent?	
	<div style="border: 1px solid black; padding: 5px;">To a magnet monitoring system and the power supply.</div>	
106.	Will thermal limit switches shut down the system?	<input checked="" type="checkbox"/> Yes
107.	Will thermal limit switches shut down accelerator operations?	<input type="checkbox"/> No
108.	Can injury to personnel or equipment occur under normal operating conditions due to thermal conditions?	<input type="checkbox"/> No
109.	Will high temperature warning labels used or needed?	<input type="checkbox"/> No
110.	Will thermal shields be used?	<input type="checkbox"/> No
111.	Will pressure relief be needed due to thermal effects?	<input type="checkbox"/> N/A
112.	Do warm-up or cool down rates need to be controlled?	<input type="checkbox"/> N/A
K. Vibration, Noise and Natural Phenomena General Comments on Section K <div style="border: 1px solid black; padding: 5px; min-height: 40px;">N/A</div>		
113.	Will vibration and noise criteria be considered for equipment?	<input type="checkbox"/> N/A
114.	Will vibration and noise sources be determined?	<input type="checkbox"/> N/A
115.	Will natural mode and vibration frequencies need to be analyzed?	<input type="checkbox"/> N/A
116.	Will noise abatement be required?	<input type="checkbox"/> N/A
117.	Will vibration damping be required?	<input type="checkbox"/> N/A

118.	Will protection against natural phenomena (earthquakes and hurricanes) be required?	<input type="text" value="N/A"/>
L. Manufacturing General Comments on Section L <div style="border: 1px solid black; height: 50px; width: 100%;"></div>		
119.	Will special manufacturing processes be needed?	<input type="text" value="No"/>
120.	Will components be built by manufacturers according to BNL supplied detailed specifications?	<input type="text" value="Yes"/>
121.	Will components be built by manufacturers according to BNL supplied detailed drawings?	<input type="text" value="No"/>
122.	Do requirements in BNL QA 101 need to be met? https://sbms.bnl.gov/sbmsearch/subjarea/10/10_Exh1.cfm?ExhibitID=6218	<input type="text" value="Yes"/>
123.	Will sole source justification be used to purchase components or systems?	<input type="text" value="Yes"/>
124.	Will a single source supplier be used to supply components or systems?	<input type="text" value="Yes"/>
M. Software, PLC, Firmware, Human Factors and Controls General Comments on Section M <div style="border: 1px solid black; height: 50px; width: 100%;"></div>		
125.	Will software be in-house or commercial?	<input type="text" value="TBD"/>
126.	For PLCs, will the configuration be documented?	<input type="text" value="Yes"/>

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127.	Will ladder logic, state tables or functional diagrams be preserved on an archived C-AD system?	<input checked="" type="checkbox"/> Yes
128.	Will software revision control be required?	<input checked="" type="checkbox"/> Yes
129.	Will the electronic design files be controlled?	<input checked="" type="checkbox"/> Yes
130.	Will there be a large amount of data logged as part of the operation of a new system?	<input type="checkbox"/> No
131.	Will the system controls be integrated into the Accelerator Controls System (ACS)? If integrated into the ACS, does the equipment utilize standard controls components and framework?	<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> Yes
132.	Will simple text pages be sufficient for console displays or will custom GUI application be required?	<input type="checkbox"/> N/A
133.	Will the design be in compliance with cyber security requirements?	<input checked="" type="checkbox"/> Yes
134.	Will the design need to comply with NEC and NFPA 70E?	<input checked="" type="checkbox"/> Yes
135.	Will the design need to comply with FCC regulation?	<input type="checkbox"/> N/A
136.	Will equipment need to be inspected by an Electrical Equipment Inspector (EEI) before being put into service?	<input checked="" type="checkbox"/> Yes
137.	Will the design need to meet interface specifications as documented in the IEEE specifications?	<input checked="" type="checkbox"/> Yes